Acute Glomerulonephritis

Purpose

This guideline is aimed at providing clinical staff at Sheffield Children’s Hospital an up to date and evidenced based clinical guidance for the assessment and management of children and young people presenting with acute glomerulonephritis.

Intended Audience

All clinicians and healthcare professionals providing care to children who present to the emergency department, AAU and the medical ward with signs and symptoms suggestive of acute glomerulonephritis.
1. Introduction

Acute glomerulonephritis develops as a result of abrupt onset of glomerular injury and inflammation that leads to a decline in glomerular filtration rate with sodium and water retention. Urinalysis usually reveals red blood cells (with red blood cell casts if the sample is very fresh) and sometimes low level proteinuria.

Patients may present with:
- Macroscopic or microscopic haematuria
- Signs of fluid overload such as hypertension and oedema
- Renal dysfunction.

In the paediatric age group, the most common cause of acute glomerulonephritis (about 80% cases) is acute post-streptococcal glomerulonephritis (APSGN).

APSGN may occur at any age, but is most common between the ages of 2 and 15 years (median age at presentation 6 - 8 yrs old)\(^1\). APSGN typically follows either pharyngeal or, less commonly, skin infection with group A streptococcus. The symptoms usually develop:
- 1-2 weeks after a throat infection
- or 3 – 6 weeks after skin infection.

The prognosis for APSGN is good, with 95% patients making a full recovery, with most clinical symptoms resolving spontaneously within 2 – 3 weeks after onset\(^2\).

Acute glomerulonephritis is unusual under the age of 1 year. Suspected cases in this age group should be discussed with a Nephrology Special Interest Paediatrician or tertiary Nephrologist (Nottingham).

2. Intended Audience

All clinicians and healthcare professionals providing care to children who present to the emergency department, AAU and the medical ward with signs and symptoms suggestive of acute glomerulonephritis.
3. Guideline Content
   A) DEFINITION
   Acute glomerulonephritis is characterised by:
     - Haematuria - macroscopic (red or tea coloured urine) or microscopic
     - signs of fluid overload such as hypertension and oedema
     - renal dysfunction (oligoanuria and rising creatinine)
     - low level proteinuria
     - RBC casts on urine microscopy (fresh urine sample).
     - Convulsion due to hypertension is also possible

   B) DIFFERENTIAL DIAGNOSIS

<table>
<thead>
<tr>
<th>Disease</th>
<th>Associated features</th>
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<tbody>
<tr>
<td>1. APSGN</td>
<td>History of sore throat, low C3, raised ASOT</td>
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<td>2. IgA Nephropathy</td>
<td>Normal C3</td>
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<tr>
<td>3. Membranoproliferative glomerulonephritis (MPGN)</td>
<td>Persisting low C3 and proteinuria beyond 3 months</td>
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<td>4. Alport Syndrome</td>
<td>May have family history of deafness or renal disease (usually x-linked dominant)</td>
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<td>5. Vasculitides especially:</td>
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<tr>
<td>5a) Henoch Schonlein Purpura (HSP) – see HSP guideline</td>
<td>Purpuric rash especially on dependent and pressure areas, arthropathy especially of the lower limbs</td>
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<td>5b) Systemic Lupus Erythematosus (SLE)</td>
<td>Butterfly rash, photosensitive rash, arthropathy, Raynaud's phenomenon, alopecia, pleuritis</td>
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<td>5c) ANCA positive vasculitis</td>
<td>Involvement of respiratory system eg. Nasal ulceration, sinusitis, haemoptysis, cough</td>
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C) CLINICAL ASSESSMENT

❖ History
To include:
Recent throat or skin infection (up to 6 weeks previously)
Previous episodes of macroscopic haematuria (IgA, Alport syndrome, MPGN, SLE, ANCA positive vasculitis)
Joint pains and swelling (HSP, SLE, ANCA positive vasculitis)
Family history of renal disease or deafness (Alport syndrome)

❖ Clinical examination
To include:
1. Height, weight, estimated body surface area (an estimate of dry weight will give a more accurate surface area estimate)
2. Blood pressure
3. Assessment of oedema (usually mild - lower limb, sacral, ascites, scrotal, pleural effusions)
4. Examination of the whole body for rashes (esp lower limbs for purpura of HSP and face for butterfly rash of SLE)
5. Cardiovascular status and perfusion (volume status):
   ▶ Indicators of fluid overload: tachycardia, hypertension, respiratory distress, warm peripheries, hepatomegaly, raised JVP
   ▶ Indicators of hypovolaemia: tachycardia, hypertension, cool peripheries, delayed capillary refill time

D) INVESTIGATIONS

❖ Urine for:
1. Dipstick urinalysis
2. Urine culture
3. Urine microscopy for casts (often not seen unless extremely fresh specimen)
4. Urine protein:creatinine ratio (confirm with early morning specimen) if proteinuria on dipstick

❖ Blood for:
Paediatric renal profile to include urea, electrolytes, creatinine, calcium, phosphate, chloride, bicarbonate and albumin.
Calculate kidney function (eGFR – as below) if creatinine is abnormal or significantly higher than previous measurement
Full blood count
Antistreptolysin titre (ASOT)
Ask lab to store blood for Anti-DNAse B and Anti-hyaluronidase titres if ASOT negative
C3 and C4 levels
Anti-nuclear antibody (ANA)
Throat swab CXR if hypertensive or fluid overloaded
**Acute Glomerulonephritis**

- **Indications for discussion with SPIN Paediatrician or Paediatric nephrologist**
  1. Estimated GFR <90ml/min/1.73m² \( [\text{eGFR} = \text{GFR} = (k \times \text{ht (cm)}) / \text{creatinine (µmol/l)}, k = 40] \). In <2 yrs, calculated GFR is not reliable. Use Creatinine of 35umol/l as upper limit of normal.
  2. electrolyte imbalance (especially hyperkalaemia)
  3. hypertension
  4. nephrotic syndrome or protein: creatinine ratio >50mg/mmol creatinine
  5. normal C3 and/or low C4
  6. signs / results suggestive of a systemic vasculitis (rash, arthralgia, other organ involvement, positive ANA)

- Further investigations to consider after discussion:
  1. Renal Ultrasound
  2. Anti-neutrophil cytoplasmic antibody (ANCA), anti-glomerular basement membrane antibody (anti GBM antibody) if renal dysfunction or signs suggestive of vasculitis
  3. General viral titres plus Hep B and C, HIV, Hantavirus
  4. C1q and C1q antibodies if SLE suspected
  5. Cryoglobulin titre (cryoglobulinaemia is a small vessel vasculitis, rare in childhood, associated with chronic infections especially hepatitis C, autoimmune disorders and B-cell lympho-proliferative diseases)

**E) MANAGEMENT**

- Post streptococcal acute glomerulonephritis usually remits spontaneously and treatment is supportive only. Children without fluid overload, hypertension or electrolyte imbalance may be managed as outpatients providing they are reviewed frequently.
- Most children will require admission to manage fluid overload, oliguria, hypertension or worsening renal dysfunction.

- **Acute management to include:**
  1. **Phenoxymethylpenicillin**
     This does not alter the natural history of the disease but prevents spread of nephritogenic strains of group A streptococcus.
     Doses are as follows:
     - 1 – 5 yr 125 mg four times a day for 10 days
     - 6 – 12 yr 250 mg four times a day for 10 days
     - > 12 yr 500 mg four times a day for 10 days

  2. **Fluid Balance**
     - Strict fluid input and urine output
     - Daily weight
     - All patients should be on a no added salt diet – dietician input
     - If oliguric (<0.5ml/kg/hr), restrict fluid input to replacement of insensible losses (400ml/m²/day) plus previous days urine output
3. **Hypertension** (ie. Bp > 95% - see hypertension guideline -CAEC Reg No 1817 - for normal ranges and further advice) – discuss with SPIN / paediatric nephrologist
   - Treat fluid overload which is the usual cause (see above)
   - If euvolaemic, use:
     - Nifedipine (starting dose 200 – 300 mcg/kg three times daily)
     - Amlodipine (starting dose 100 – 200 mcg/kg once daily)
     - Do not use ACE inhibitors as these can reduce renal function.
     - Beta blockers can exacerbate hyperkalaemia.

4. **Hyperkalaemia** – discuss with SPIN / paediatric nephrologist.
   - If K <6.0mmol/l, arrange dietary review and stop medications that might exacerbate hyperkalaemia

   - If K 6.0 – 6.5 mmol/l:
     If not dehydrated, give 1-2 mg/kg Furosemide
     Check ionised calcium (blood gas) and if low, give slow bolus 10% calcium gluconate
     Check acid base status and if HCO₃ <18 mmol/l, give sodium bicarbonate 2mmol/kg/day in 4 divided doses.
     Recheck Potassium after 4-6 hours

   - If K > 6.5 mmol/l – this is a medical emergency
     Continuous cardiac monitoring (Changes associated with hyperkalaemia include tall peaked T waves, flattening or loss of p waves, broad QRS complexes and bradycardia)
     Check and treat hypocalcaemia and acidosis as above
     Give nebulised salbutamol
     Follow hyperkalaemia guideline

   - **Indications for Dialysis** –
     1. Fluid overload causing pulmonary oedema, cardiac failure, symptomatic / severe uncontrollable hypertension.
     2. Persistent oligoanuria or rapidly rising urea and creatinine.
     3. Hyperkalaemia - urgently if symptomatic or severe, sub-acute/ly if asymptomatic or less severe hyperkalaemia which cannot be adequately controlled by other measures.
     4. Other biochemical imbalance - symptomatic/severe hyponatraemia, acidosis, hyperphosphataemia.
     5. Symptomatic uraemia (nausea, vomiting, fatigue, pruritus, change in mental status etc)
F) DISCHARGE

- If renal function is satisfactory and improving and the patient is normotensive, an early discharge should be possible with early and regular outpatient follow up.

- Signposting to the infoKID website (www.infokid.org.uk) would also be useful for the family. It can also serve as the written information for the family.

- 95% of patients with post streptococcal glomerulonephritis will make a complete recovery, however, a small proportion will develop rapidly progressive glomerulonephritis

G) FOLLOW UP pathway

On discharge:
- Estimated GFR >90 ml/min/1.73 m²
- Normotensive
- No proteinuria
- Normal albumin

On discharge, any of:
- Estimated GFR <90 ml/min/1.73 m²
- Hypertension
- Proteinuria > 50 mg/mmol
- Low albumin

- Hypertension
- Proteinuria > 20 mg/mmol
- Low C3 (after 3 months)
- Low C4
- Low albumin
- Estimated GFR <90 ml/min/1.73 m²

Review as outpatient as clinically indicated
- bp
- urinalysis

3 month clinic review –
- bp
- urinalysis
- complement levels
- albumin
- creatinine (estimate GFR)

6 monthly clinic review:
- bp
- urinalysis

Note microscopic haematuria may continue for up to 2 years and is of no prognostic relevance. Therefore no need for parents to check dipsticks

- Can be discharged with normal urinalysis and normal BP on at least 2 visits
4. References


3) Nottingham University Hospital Clinical Guideline for the assessment and management of acute glomerulonephritis in children and young people, updated May 2016